PROJECT FINAL REPORT

Reevaluation of Age Determinations Used in Illinois Deer Harvest Management

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REEVALUATION OF AGE DETERMINATIONS USED IN ILLINOIS DEER HARVEST MANAGEMENT

Alan Woolf and John Roseberry

Knowledge of age-specific survival rates enhances understanding of herd dynamics and the effects of harvest strategies and intensities on wildlife populations. Vital statistics necessary to properly manage the white-tailed deer resource in Illinois have been obtained since resumption of deer hunting in 1957 by examination of hunter harvested deer at mandatory check stations. Ages of harvested deer are estimated by check station personnel following eruption and wear criteria (Severinghous 1949). Accuracy and precision of these age assignments have long been questioned, both nationally and in Illinois. Roseberry and Hardin (1978) evaluated applications of tooth eruption and wear criteria under Illinois check station conditions; compared results of check station aging with those from a commercial laboratory using cementum annuli techniques; analyzed comparison geographically; determined effects of discrepancies on estimates of survival; and made recommendations regarding collection of biological information from check stations. More recently, Howe (1980) examined the tooth sectioning method to age deer in Illinois and compared age determinations to those obtained at deer check stations in west central Illinois.

Growing need for more intensive management of the deer resource coupled with conflicting results of age determination studies warrant further study. The present investigation was conducted to reevaluate the findings of Roseberry and Hardin (1978) and previous recommendations pertaining to acquisition of age-structure data from deer check stations. Specific objectives were to: 1) determine precision of cementum annuli age assignments by a commercial

laboratory; 2) compare age assignments based on tooth eruption and wear criteria with those based on cementum annuli counts of longitudinal sections determined at a commercial laboratory, and transverse sections prepared at our laboratory; 3) examine regional variation in precision of age assignments by the cementum annuli technique; 4) compare age assignments of yearlings based on eruption criteria versus cementum annuli; and 5) formulate recommendations for obtaining age data at Illinois deer check stations.

METHODS

During the November-December 1983 Firearms deer season, jaws were collected at the Crab Orchard NWR check station from 59 deer considered 2.5 and older. Ages were assigned by Woolf and Roseberry based on wear criteria. Incisors from each plus paired incisors from a subsample (n=28) were extracted and sent to a commercial laboratory (Matson's, Milltown, MT) for processing and age determination by cementum analysis. In 1984, jaws from 67 deer were similarly obtained and handled, except subsets represented northern, central and southern Illinois geographic regions. In addition, paired incisors from 34 deer harvested at Crab Orchard NWR were used to compare processing technique (longitudinal versus transverse sectioning) for cementum analysis. In 1984/1985, samples from 67 yearling deer were collected from check stations in northern, central and southern Illinois regions. Accuracy is not presumed for age assignments of adult deer (2.5 years and older) by either wear criteria or cementum annuli except for 3 known-age animals included in the 1984 sample. Yearlings aged by replacement criteria are presumed to be an accurate basis upon which to compare cementum annuli age assignment.

RESULTS AND DISCUSSION

Precision of Cementum Annuli Age Assessments

The 1983 sample of 2.5 years and older deer from Crab Orchard NWR included 18 aged as 4.5 years or 4.5+ years by wear criteria; almost all were assigned an older age by annuli examination. Precision of 11 paired samples was rather good; 7 were assigned similar ages. The most serious discrepancy was a deer aged as 4.5 years by wear criteria whose paired sections were assigned ages 4.5 and 7.5, both with Matson's "certainty code" B. Because the "certainty codes" represent interpretation of distinctness of annuli patterns, they reflect precision to some degree. Ten of these older teeth were assigned code A, 16 code B and 3 code C. The A codes were all assigned to teeth aged 7.5 years or older.

Agreement of wear-assigned 2.5 and 3.5 year classes with annuli ages was only 44.0 and 47%, respectively. However, precision of the paired samples was high; 9 of 10 matched for 2.5 year-olds and all 7 for 3.5 years. The pattern of "certainty code" distribution (A, B and C) was 5, 24, 6 and 7, 15 and 0 for 2.5 and 3.5 year-olds, respectively. Roseberry and Hardin (1978) found there was relatively greater precision achieved for older than for younger age classes and these data generally support that contention. This is seemingly a product of annuli becoming more distinct in later years (Gasaway et al. 1978).

A final measure of precision was examination of annual variation among 1983 versus 1984 assignment of certainty codes to Crab Orchard NWR deer aged by cementum annuli. Although 33.7% of the 1983 sample was 4.5 years and older in contrast to only 23.8% of the sample in 1983, nearly twice as many deer (47.6 versus 25.6%) were assigned code A in 1984 suggesting greater

precision. This magnitude of difference in the "ease of aging" deer collected from the same local 2 concurrent years diminishes the value of derived age assignments for survival estimates.

Regional Variation in Precision of Age Estimates

The 1984 sample of 67 deer included 42 from Crab Orchard NWR, 12 from Adams County in central Illinois and 13 from Jo Davies County in northern Illinois. Although the sample was small, 66.7% of teeth from Adams County and 84.6% of those from Jo Davies County were assigned the A code in contrast to only 47.6% from Crab Orchard NWR (southern Illinois). A similar comparison by Roseberry and Hardin (1987) revealed a similar trend, but lesser "certainty"; proportion of teeth assigned the A code for northern, central and southern Illinois was 18.9, 22.9 and 11.6%, respectively. Clearly the precision of age assignments is less in southern regions in contrast to northern portions of the state. Lack of comparable precision of age assignments in different Illinois regions along a north-south gradient must be considered in any application of harvest data to population analysis.

The variable precision is also reflected in variable regional agreement between check station age assignments and those derived from annuli counts. Our sample was too small for useful comparison, but Roseberry and Hardin (1978) found percent agreement between method of aging deer 2.5+ was less in southern (53.8%) than in northern (73.3%) Illinois. Central Illinois had 46.7% agreement suggesting confounding effects and the lack of distinct regional variation along the gradient. Unless factors influencing temporal and spatial variation in apparent precision of aging are understood, statewide and regional analyses of herd harvest data based on age structure of the kill are subject to errors of unknown magnitude and predictability.

Comparison of Age Assignments

Jaws from 42 Crab Orchard NWR deer collected in 1984 were cleaned and aged in the laboratory by us; a consensus was reached on 36, but we could only agree on a range of 1 yr for the remaining 6. The consensus tooth replacement and wear ages were then compared to Matson's assignments and paired samples (n=31) of transverse sections prepared at our laboratory using standard histological techniques (Table 1).

Table 1. Comparison of ages assigned to deer harvested at Crab Orchard NWR by tooth replacement and wear, longitudinal section from a commercial laboratory, and multiple transverse sections.

	Number Agree/Number Examined (Percent Agreement)	
Age	Longitudinal	Transverse
1.5	5/10 (50.0)	7/8 (87.5)
2.5	11/11 (100.0)	8/8 (100.0)
3.5	1/6 (16.7)	5/6 (83.3)
4.5	2/6 (33.3)	3/4 (75.0)
5.5	1/2 (50.0)	1/2 (50.0)
6.5+	1/1 (100.0)	1/1 (100.0)
	21/36 (58.3)	25/31 (80.6)

The transverse sections prepared in our laboratory were in better agreement with assigned ages. Better accuracy of the transverse section analysis is presumed because fewer yearling deer were misidentified and 3 known age deer

(1 each 2.5, 3.5 and 4.5) were correctly aged using multiple transverse sections, but only the 2.5 was correctly aged (code B) by the commercial laboratory. The commercial laboratory ages did not agree with assigned ages in 6 of 20 animals given a certainty code A. This is further evidence that implied precision does not equate to accuracy of aging southern Illinois deer. We attribute our better "accuracy" to the advantage of having multiple sections (3-6) from different root areas allowing selection of the most obvious annuli and best areas for interpretation. Gasaway et al. (1978) noted the subjectivity of interpreting annuli and Campbell (1967) and Lockard (1972) indicated the advantages of using numerous sections of individual teeth to ensure accurate annuli counts. Roseberry and Hardin (1978) noted that such effort would not be feasible for a commercial laboratory and could only be justified in studies requiring relatively small samples.

Yearling Age Assignments

There were 2 yearlings in the 1984 data set from northern Illinois; 1 was properly aged with a certainty code A, but the other was aged as a 2½ year old (code B). Ten yearlings were in the set from southern Illinois; only 5 were correctly identified from tooth sections prepared and read by Matson, but 7 of 8 paired samples were correctly aged as yearlings using multiple transverse sections (Table 1). Although Roseberry and Hardin (1978) noted that Matson incorrectly classified 28% of their 2.5 year old sample as yearlings, we did not encounter that error.

To further compare the utility of annuli interpretation to age yearlings, we examined just yearling jaws in 1985. The uncertainty of aging yearlings by annuli was evident in the certainty code assignments; only 56.2% were classified A. The increased difficulty of aging deer from more southern

latitudes was evident in regional variation in certainty codes; 48.4% of southern Illinois yearling deer were code A in contrast to 62.5% of northern Illinois deer and 66.7% of central Illinois deer. Accuracy of yearling age assignments was highest in central and northern Illinois; 1 of 12 (8.3%) and 2 of 24 (8.3%) were incorrectly aged from the respective regions and they all were considered 2.5 years with a B code. In contrast, 12.9% (4 of 31) of southern Illinois yearlings were incorrectly aged; 2 were considered 4.5 (both code A), 1 was 3.5 (also code A) and the last was called 2.5 (code B).

Roseberry and Hardin (1978) considered disagreements in the yearling and 2.5 classifications as the most disconcerting aspect of their study. We agree, but while the former found Matson correctly aged 1.5 year olds most of the time, but incorrectly aged some 2.5 year deer as yearlings, we found the opposite. The discrepancies in yearling classifications must be presumed a problem of cementum annuli interpretation or simply limitations of the technique. Age assignments based on tooth replacement criteria when there is a 3-cusped premolar present are considered certain and no evidence exists to dispute that contention.

CONCLUSIONS AND RECOMMENDATIONS

Previous evaluations of method of aging deer harvested in Illinois identified problems in techniques and applications. Roseberry and Hardin (1978) did not recommend use of the dental cementum technique for age determination based on their findings. They noted costs and apparent inaccuracies would preclude use of the technique on a statewide basis. They further noted ... "Check station personnel satisfactorily aged yearlings (and presumably fawns); however, apparent mistakes in age determinations led to an overestimation

of the strength of the 2.5 year cohort and an underestimate of the 3.5 and 4.5+ classes" (Roseberry and Hardin 1978:20). Their recommendation was that jaws from 2.5+ deer be collected at each check station and aged at a central location by trained personnel; fawns and yearlings could be properly aged at check stations by personnel with less training. They further noted that little information would be lost by simply designating males as fawns, yearlings or adults (2.5+) at check stations and only collecting jaws from females older than yearlings.

Howe (1980) also concluded that deer could be aged as fawns, yearlings or adults at the check stations with a fair degree of accuracy, but that adult deer should be aged by the cementum annuli technique. He thought teeth collected at check stations should be processed by a commercial laboratory to reduce cost.

He did not specifically evaluate the ability of check station personnel to "correctly" age deer, but our experience at check stations substantiates the findings of both previous studies. However, the lack of precision (and apparent accuracy) of cementum annuli aging apparent in our study does not support the recommendation that adult deer be aged by a commercial laboratory. Examination of multiple transverse sections seemingly improves accuracy of age assignments, but uncertainty still exists so expected benefits do not justify costs. Our recommendation is that deer be classified as fawn, yearling or adult at check stations. Counties or regions where herd status must be judged on a more refined basis should be identified and every effort made to collect jaws from adult does for later aging by experienced personnel at a central location. Alternatively, well-trained Illinois Department of Conservation staff should be assigned to these counties if jaws cannot be

collected. In any case, analyses of herd status and population dynamics based on harvest age-structure data should be limited to application of those techniques not dependent on accurate age-specific survival rates. Regional variation in precision and accuracy of age determinations precludes development of correction factors or any application on a statewide basis. Basic research using captive animals to determine factors influencing annuli formation, deposition rates and clarity are needed before reliable age determinations can be made from tooth sections. Also, a large sample of known-age deer from southern, central and northern regions of Illinois need be examined before aging accuracy can be reliably assessed and techniques applied to harvest data and subsequent analysis. Even if such studies were undertaken, findings would not be available in the short-term.

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